REMARKS

This amendment is submitted in response to the Office Action dated January 3, 2002. A petition for a one month extension of time is enclosed herewith to bring the date of response to May 3, 2002. Claims 14 to 19, 21 and 49 are currently pending in this Application, and the claims are not further amended in this response.

The Examiner rejects claims 14-19, 21 and 49 under 35 U.S.C. 112, first and second paragraph as containing subject matter not enabled and as being indefinite, respectively. Applicant respectfully traverses this rejection and submits that the claims are both definite and enabled by the specification.

The claims as currently presented are directed to a method of combusting a propellant that exhibits certain specific criteria during combustion. Applicant respectfully submits that this criteria is clearly and definitely defined in the claims. The claims are directed to a methodology which the inventors have discovered leads to desirable regression rates. Applicant respectfully submits that the claims as presented properly set forth the metes and bounds of the invention. Applicant does not intend to encompass all substances as the Examiner suggests, only propellants that satisfy the specific criteria of viscosity and surface tension values in claim 49, and alternatively the a_{onset} value in claim 14, will fall within the scope of the claims. Applicant would like to emphasize that the present claims are directed to a method, and this method of combusting is not taught or suggested by the prior art.

Regarding the equation for a_{onset}, the relationship was not known in the field, but has been discovered and developed by the inventors. This development and the applicability of the relationship is described in the application, specifically at pages 31 to 33 of the application. For example, the last sentence on page 31 states "....the method of selecting a high regression rate fuel is provided in stepwise fashion as follows." There follows on pages 32 and 33 the stepwise procedure. Specific examples are shown on pages 34 and 35 for a paraffin wax with a melting point of 66.6 °C. Values of B are taught on page 33, and finally in Table 2 values of a_{onset} are shown for six other compounds. Table 2 includes all of the physical data needed to calculate a_{onset} using the

values of B as suggested in the application. Applicant submits that one of ordinary skill in the art can calculate a_{onset} and determine whether a candidate fuel is likely to entrain according to the method of the present invention.

Regarding the Examiner's argument of undue experimentation and the citation of *PPG Industries*, Applicant again submits that one of ordinary skill in the art can identify propellants according to the claimed method without undue experimentation. The aspect of entraining droplets is enabled and clearly taught in the specification. The Examiner is again referred specifically to the stepwise procedure and examples described at pages 32 to 36 of the specification. Additionally, the entrainment onset parameter a_{onset} is clearly described for example at pages 21 to 24, and the values where entrainment will occur are shown on page 22. Applicant respectfully submits that those of ordinary skill in the art can calculate the entrainment onset parameter for materials of interest given the teaching of the present invention. Once that parameter is known, it is then compared with the values given in equation 18, page 22, to predict whether entrainment is likely to occur. At page 22, specific ranges of values of a_{onset} are provided showing where the best results are expected. Pages 32 to 36 give specific examples.

Many working examples are provided to give further guidance and direction for practicing the invention. Table 1 lists various propellants tested and shows exemplary rocket or engine parameters such as the initial port diameter, the port length, the oxidizer gas flow rate, the burn time, and the resultant regression rate. Relevant fuel variables for a number of propellants are shown in Table 2, and the entrainment onset parameters are shown. Those of skill in the art can easily obtain the physical parameters of other materials as such parameters are widely published in known references or experimentally determined by routine experimentation. Further, guidance and direction are provided in Figure 9, among others showing, the entrainment of the propellant as a function of the molecular weight. These are exemplary, and the Applicant respectfully submits that there is considerable teaching, guidance and direction in the specification and drawings on how to practice the claimed invention.

Regarding the Interview Summary previously entered the Examiner requests that the Applicant further supplement the record, specifically that the Applicant clarify the propellant compositions of the difference rocket firings demonstrated in the video. Applicant provides the

following summary of each of the four runs. Each of the four runs correspond to Images 1 to 4 attached hereto. Images 1 to 4 are still shots from the video showing the flame production. These Images were previously submitted; however, they are again submitted and are in color which Applicant believes make the Images more clear. To supplement the earlier Interview Summary, the following information is provided:

Image 1 - is from sequence 1 on the video and corresponds to the combustion of Plexiglass (PMMA), a prior art fuel. The data for this test is shown in column 3 of Table 1 in the specification, and has a measured regression rate of 0.028 cm/sec.

Image 2 - is from sequence 2 on the video and corresponds to the combustion of high molecular weight polyethylene wax (PE wax), a prior art fuel. The data for this test is shown in column 4 of Table 1 in the specification, and has a measured regression rate of 0.036 cm/sec.

Image 3 - is from sequence 3 on the video and corresponds to the combustion of Paraffin wax B, according to the method of combusting of the present invention. The specific composition of the fuel is paraffin wax B (also referred to as FR5560) having a mean carbon number of 32 (mean melting point of 69 °C), and 0.5 weight percent carbon black. As shown the regression rate is much higher than the prior art fuels, and in this test the regression rate is 0.100 cm/sec as shown in column 6 of Table 1 in the specification.

Image 4 - is from sequence 4 on the video and corresponds to the combustion of Paraffin wax A, according to the method of combusting of the present invention. The specific composition of the fuel is paraffin wax A (also referred to as FR4045) having a mean carbon number of 28 (mean melting point of 61 °C) and 0.5 weight percent carbon black. Again, as shown the regression rate is much higher than the prior art fuels, and in this test the regression rate is 0.114 cm/sec as shown in column 5 of Table 1 in the specification.

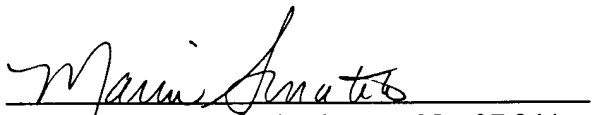
Note that the oxidizer flow rate and the initial port diameter is the same in all four tests. The photos graphically illustrate the significantly higher combustion rate - in fact greater than an order of magnitude - of the method of the present invention over the prior art. The prior art fuels in the video do not entrain, that is they do not meet the method criteria of claims 14 and 49 and thus the prior art fuels exhibit significantly inferior combustion.

The Examiner rejects Claims 14-19, 21 and 49 under 35 U.S.C. 102(b) as anticipated by or,

in the alternative under 35 U.S.C. 103 as obvious over each of Strickler, Anderson and Goode. Applicant respectfully traverse the rejections and submits that none of the cited prior art references teach, or reasonably suggest, the method of the present invention. Stickler teaches that the overall rate of the combustion process is limited by the rate at which heat is transferred to the solid fuel dQ/dt (Col. 2, lines 1 to 15). This is the conventional focus on heat transfer as the dominant mechanism. Stickler teaches increasing the heat transfer, and in particular roughening the surface to create droplets into the gas during combustion. Strickler is limited to this mechanism and does not teach or suggest a method of combusting having a melt layer which satisfy specific criteria that promote entrainment of droplets from the melt layer into the oxidant as claimed in the method of the present invention. None of the prior art references teach or suggest the concept of an entrainment onset parameter, let alone suggest how one would develop such a relationship. Applicant respectfully submits that after reading Strickler, Anderson and Goode, either alone or in combination, one would not be motivated to arrive at Applicant's claimed invention.

Based on the foregoing, Applicant respectfully submits that the application is now in condition for allowance. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned attorney at the telephone number listed below. The Commissioner is authorized to charge any additional fees to Deposit Account No. 06-1300 (Order No. A-67587-1/AJT/MSS).

Respectfully submitted,



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